



Chuitna Metals Mixture Text

William Beckwith Powell,
to: James E
(DEC),

06/06/2011 04:12 PM

Jim and Pete - I am forwarding the comments below (a. thru g.) that I received from Chuck Stephan, EPA's Office of Research and Development in Duluth, on the Chuitna metals mixture test (the 1/7/11 memo from Jerry Diamond and Henry Latimer, Tetra Tech, to Dan Graham, PacRim Coal that we received from Dan Graham by email of 5/9/11). With regard to comment a., we understand that the intent was to run acute tests with a mixture of each metal at its proposed acute criterion. Nevertheless, it might be appropriate to consider whether an authorized discharge level would need to be at the acute aluminum criterion (750 ug/l), particularly if the receiving water aluminum data indicate lower concentrations.

Also, the stream chemistry and stream flow data for the site water sample should be reported to document that it was a representative site water sample, i.e., pH, alkalinity, hardness, total and dissolved organic carbon, conductivity, TSS, stream flow, and any other parameters that were measured.

As was the case with the manganese comments I sent on 5/4/11, these comments on the metals mixture test can also be forwarded to Dan Graham, but thought you should see them first.

Please contact me if you have questions.

- Bill
206-553-2495

- a. The tested concentration of aluminum was 750 ug/L, which apparently is the Alaska state acute water quality standard. The rationale for using the highest possible concentration of aluminum in the mixture test is questionable at best. The concentration of aluminum used in the test is important because the investigators acknowledge that aluminum (or alum) is a standard flocculant in wastewater treatment and readily combines with other metals, resulting in low dissolved metals in solution.
- b. The percent survival of 85% obtained in the mixture test with *D. magna* is below the 90% survival that is the standard for acceptability of acute toxicity tests. It appears that because the percent survival was less than 90%, the standard for

acceptability was inappropriately changed to one based on hypothesis testing. Satisfying a standard for acceptability of 90% is not unreasonable because the survival percentages in the lab control and the site water were 95% and 100%, respectively. The percent survival in the mixture test (i.e., the spiked site water test) was too low.

- c. For copper, lead, and zinc, dissolved metal is the only metal that can be considered bioavailable and toxic in this mixture test. Thus the concentrations of these three metals that can be deemed safe in the mixture test are those given in Tables 2 and 3 in the columns labeled "Measured dissolved". It should be acceptable to use the averages of the concentrations given in the two tables for each of the three metals. These concentrations are about 42, 13, and 54% of the proposed dissolved acute criteria for these three metals. Therefore, the mixture test shows that the toxicity of the mixture of the three metals is greater than what would be predicted on the basis of tests on the three metals individually, especially considering that the percent survival in the mixture test with *D. magna* was only 85%.
- d. It is inappropriate to convert the dissolved concentrations from the mixture test to total concentrations for use in site-specific criteria using the percent dissolved observed in the mixture test because the percent dissolved in the mixture test is greatly affected by the high concentration of aluminum that was present in that test. The values that are used for percent dissolved need to be consistent not only with the concentration of aluminum in the downstream site water but also with the form of aluminum in the downstream site water. Alternatively, the values of percent dissolved obtained from the tests on the individual metals can be used.
- e. It would be interesting to see what results would be produced by a mixture test in which no aluminum was added. It is very possible that the ratios of the dissolved concentrations of the three metals would be different from the ratios that were produced by the mixture test that was performed using a high concentration of aluminum..
- f. Near the bottom of page 2 of the 1-7-11 memo from Diamond and Latimer to Graham, it says that dissolved metal "is bound to natural constituents in the site water and is no longer measurable as dissolved" and "this is especially the case for lead but is true for copper and zinc as well". However, "bound to natural constituents" is not necessarily true if a high concentration of aluminum is present in the mixture test.
- g. The last sentence on page 6 ends by saying "these results

demonstrate that the proposed criteria are suitable for application to this system”, but this is not true for the proposed dissolved criteria. This would not even be true for the proposed dissolved criteria if the percent survival in the mixture test with *D. magna* was 95% rather than 85%. The mixture test with *D. magna* demonstrates that a mixture of the proposed dissolved criteria for copper, lead, and zinc is not suitable for application to this system.